

Bowhunter's syndrome diagnosed with provocative digital subtraction cerebral angiography

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Bowhunter's syndrome, also known as rotational occlusion of the vertebral artery, involves posterior circulation ischemia resulting from dynamic compromise of the dominant vertebral artery. This case highlights the importance of provocative digital subtraction angiography in making the diagnosis. A 41-year-old man presented for outpatient neurological evaluation for "lightheadedness" of several years' duration provoked by leftward head rotation. The only abnormality identified on initial magnetic resonance angiography was atresia of the nondominant left vertebral artery. Conventional digital subtraction angiography (DSA) followed by provocative DSA revealed development of a dynamic stenosis of the right vertebral artery involving the extraforaminal segment just superior to the C1 vertebra. Noncontrast computed tomography of the cervical spine confirmed ossification of the posterior right atlanto-occipital membrane leading to a near complete bony arcuate foramen. Following neurosurgical decompression, the patient demonstrated complete resolution of all neurologic symptoms. Bowhunter's syndrome is a unique clinical entity that must be considered in the evaluation of patients with symptoms of posterior circulation ischemia. Provocative DSA remains the preferred modality for definitive diagnosis.

A 41-year-old man presented with "lightheadedness" of several years' duration. His symptoms were provoked only by leftward rotation of the head. This position reliably resulted in presyncope, which was quickly relieved by returning to a neutral position. Cervicalgia and neurologic deficits were absent. The patient disclosed a medical history significant only for colon cancer. Examination revealed mild left-sided ataxia while performing the heel-to-shin maneuver. The remainder of the exam was unremarkable.

Because of the clinical suspicion for vertebrobasilar insufficiency, an intracranial and extracranial magnetic resonance (MR) angiogram was requested. It disclosed an atretic left vertebral artery, but no other abnormality. A conventional cerebral digital subtraction angiogram (DSA) was subsequently performed followed by provocative DSA. Initial angiographic images obtained in the neutral position revealed no diagnostic abnormality. Specifically, the posterior arterial circulation was patent (*Figure 1*). The patient was asked to rotate his head leftward, and additional angiographic images were obtained. These revealed dynamic development of a severe stenosis of the right vertebral artery involv-



Figure 1. Digital subtraction angiographic image of the posterior circulation demonstrates patency of the right vertebral artery without evidence of significant focal stenosis.

ing the extraforaminal segment just superior to the C1 vertebral body (*Figure 2*). The immediate cause of the dynamic stenosis was not evident by conventional angiogram. To better evaluate the osseous structures of the cervical spine, a noncontrast computed tomography (CT) exam was performed and confirmed ossification of the posterior right atlanto-occipital membrane resulting in a near complete bony arcuate foramen (*Figure 3*).

The patient underwent decompression of the right vertebral artery by removal of osteophytic ridging associated with the C1 vertebral body. Ultimately, the patient experienced complete resolution of all neurologic symptoms induced by rotational head movement.

DISCUSSION

Bowhunter's syndrome is the clinical manifestation of posterior circulation ischemia provoked by dynamic compromise

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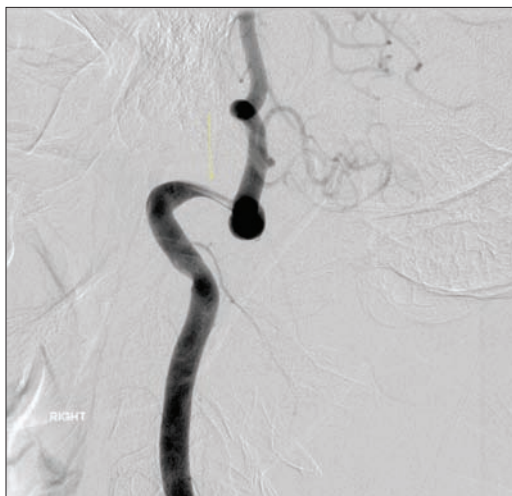


Figure 2. Dynamic digital subtraction angiographic image obtained following leftward rotation of the patient's head reveals development of a severe stenosis of the right vertebral artery involving the extraforaminal segment just superior to the C1 vertebral body.

of the dominant vertebral artery. The colloquial name refers to the rotational position of the head that a bowhunter assumes when properly aiming his bow. In adults, bowhunter's syndrome is most commonly caused by rotational compression of the dominant vertebral artery by a hypertrophic osteophyte, typically arising from the uncovertebral joints (1). This results in dynamic impingement upon the vessel lumen, compromising flow to the posterior circulation and provoking typical features of vertebrobasilar insufficiency. Classic examination findings are rotational vertigo with horizontal nystagmus towards the compressed artery (1). The most common inciting factor in bowhunter's syndrome is cervical spondylosis, although numerous additional causes have been identified, including surgical fixation, chiropractic manipulation, and rheumatoid subluxation (2). Other causes of vertebral artery compression secondary to a fibrous band or a thickened atlantoaxial membrane have also been reported (3).

The vertebrobasilar system is composed of paired vertebral arteries, which may allow for compensation in the instance of unilateral disease. However, one of the vertebral arteries, more commonly the left, is often found to be significantly larger than the contralateral side and provides the majority of inflow to the posterior circulation. Bowhunter's syndrome is classically described as affecting the dominant vertebral artery, although cases involving the nondominant vessel have been documented (4). The ischemic changes of bowhunter's syndrome are commonly transient, though permanent deficits, including lateral medullary infarcts (Wallenberg syndrome), have been described (4).

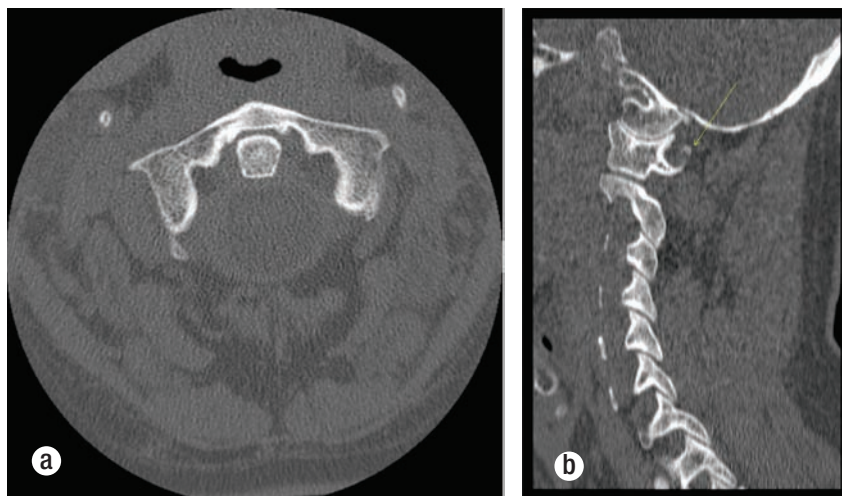


Figure 3. CT images through the cervical spine obtained in the bone window in the (a) axial and (b) sagittal planes demonstrate ossification of the posterior right atlanto-occipital membrane.

Although ultrasound, CT, or MR angiography may demonstrate disease, for a number of reasons, DSA is the preferred method of diagnosis. DSA provides precise localization of the flow-limiting lesion and confirms that the occlusion occurs during head rotation (1). Treatment for this condition is most often surgical; however, conservative measures such as neck immobilization or a conscious effort not to rotate the head to the affected side may initially be attempted. Surgical treatment most commonly consists of osseous decompression tailored for the patient's particular cause of rotational compression, and, if cervical subluxation is the cause, fixation has been advocated (5, 6). Recently, there has also been discussion of stent deployment in the contralateral vertebral artery if it has hemodynamically significant severe atherosclerotic stenosis (7).

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